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(54) **A cutoff machine for tubular elements**
Schneidemaschine für rohrartige Elemente
Machine de coupe d'éléments tubulaires

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Description

[0001] The invention concerns a cutoff machine according to the preamble of claim 1. Such a machine is disclosed in DE-A-3120009.

[0002] Specifically, though not exclusively, the cutoff machine is useful for "running" cuts effected on tubular elements produced by continuous cold-forming on motorized and non-motorized rollers.

[0003] Among known and used cutting systems there is a system known as "dimple-free" which consists in using two tools whose movements are mechanically constrained one to the other. One of these is a scoring tool, which makes a first incision tangentially to the tubular element, while the other is a cutter or blade, which makes the full cut, starting from the incision made by the scorer. The mechanical constraint between the two tools is rigid in the sense that they are both part of a same mechanism. Thanks to this unified mechanism the movements of the two tools are determined one in function of the other, i.e. a determined position of one always corresponds to an equally-determined relative position of the other).

[0004] A mechanism transforms the non-active vertical movement of the cutting tool into the active part, i.e. the working run, of the scoring tool, which run is perpendicular to the vertical movement of the cutting tool. The order of operations is thus: the scoring tool removes the superficial part of the tubular element, immediately following which the cutting tool penetrates into the score made by the scoring tool and performs the complete cut. Throughout the operation the tubular element is clamped by little vices which are specially activated for the purpose.

[0005] These machines however have some drawbacks which heavily compromise their use.

[0006] The operation of the two tools is fixed, independently of the size and material of the elements to be cut (the cutter run-cycle is of fixed entity). This means that tile cutting cycle times are not adaptable, in economically viable terms, to situations where the elements to be cut have varying characteristics (size, materials).

[0007] The main aim of the present invention is to provide a cutoff machine for tubular elements which can overcome the above-mentioned drawbacks in the prior art.

[0008] More specifically, the main aim of the present invention is to optimize the removal of material by the scoring tool independently of the operation speed of the cutter.

[0009] A further aim is to increase considerably the working life of the scoring tool. A further aim is to make the element cutting time proportional to the size of the workpiece element without changing the cutting tool speed.

[0010] An advantage of the invention is constituted by the considerable operational flexibility of the cutting tool.

[0011] These aims and advantages and others besides are all achieved by the present invention, as it is

characterised in the claims that follow.

[0012] Further advantages of the present invention will better emerge from the detailed description that follows of a preferred but non-exclusive embodiment of the invention, illustrated purely by way of non-limiting example in the accompanying figures of the drawings, in which:

figure 1 is a schematic perspective view;

figure 2 and figure 3 are two frontal views in two different operating configurations.

[0013] With reference to the figures of the drawings, 1 denotes in its entirety a mobile cutoff machine for tubular elements, which is mounted in a production line (not illustrated) of tubular elements 6 made by continuous cold-forming by special roller-forming machines.

[0014] The mobile cutoff machine 1 illustrated employs a scoring tool 2 for making a first incision tangentially on the element, and a blade 3 for making the actual deep cut starting from the score made by the scoring tool 2.

[0015] During these operations the element 6 is held solidly gripped by the vices 7 which remain active for the time strictly necessary for completing the total cut. The cutoff machine 1 is characterized by the fact that it comprises means for autonomously commanding and guiding the working run-cycle of the scoring tool 2 as well as distinct means for autonomously commanding and guiding the working run-cycle of the blade 3.

[0016] In particular, the means for autonomously commanding and guiding the working run of the scoring tool 2 comprise an autonomous actuator, which produces a working run-cycle consisting in a translation in both directions along a first predetermined axis, denoted by x, which, in the example, is horizontal and perpendicular to the longitudinal axis of the element 6, denoted by y (which coincides with the axis of advancement of the element 6).

[0017] The blade 3 is guided autonomously to translate in a vertical direction by the columns 4 and commanded by a press mechanism characterised by a rotating shaft which causes the blade 3 to move along a second axis, indicated by z, which is perpendicular to the axis x.

[0018] In the illustrated embodiment, the actuator commanding and guiding the scoring tool 2 comprises a headstock 5 which moves along the first axis x driven by a ball-bearing-screw coupling.

[0019] A further embodiment of the invention, not illustrated, provides for use of a similar headstock driven along axis x by a rack-and-pinion mechanism.

[0020] In a further embodiment, also not illustrated, the actuator which autonomously commands and guides the scoring tool 2 comprises a hydraulic cylinder specially dimensioned so that the high-pressure oil chamber is small, thus reducing the problem of oscillation due to oil compressibility. The cylinder is actuated through a closed-circuit servo-valve which can achieve movement through controlled inertia forces.

[0021] The scoring tool 2 is preferably symmetrical with respect to a vertical plane perpendicular to the first axis

x inasmuch as it exhibits, symmetrically with respect to the vertical plane, two scorers 20, one of which operates in the work motion direction, the other in the opposite direction.

[0022] This symmetrical arrangement of the scorers 20 on the scoring tool 2 means that in a simple run-cycle (i.e. in both directions) the tool can score twice, with an obvious gain in terms of time and a doubling of the working life of the tool itself with respect to machines equipped with only one active cutting side and in which, obviously, a cutting cycle involves an empty return run.

[0023] This ability to cut in both run directions enables the cutting cycle time to be reduced to a minimum, because it eliminates some dead times (the return cycle).

[0024] Furthermore the independence of the scoring tool 2 from the blade 3 means that the cutting parameters can be optimized independently for each of the tools.

[0025] In particular, the independent motion of the blade 3 means that the blade 3 itself can be positioned variably according to the dimensions of the tubular element 6, maintaining the start cut position (i.e. the start position of the active run of the tool) at a fixed distance from the highest point of any tubular element. In the work cycle of a moving cutoff machine, it will therefore be possible to reduce the time spent synchronised at element-advancement speed, equal to the cutting time, allowing the blade 3 to re-position itself for following stages (inversion of the truck, return etc.)

[0026] The cutting time cycle can therefore be optimized and calibrated according to the particular dimensions of the elements to be cut. It is therefore possible to use a same cutoff machine both for small elements with high-speed cutting times, i.e with short cutting time requirements, and for large-size elements requiring a proportionally longer cycle; there is no need to change the machine configuration.

Claims

1. . A cutoff machine for tubular elements, comprising a scoring tool, which scoring tool (2) makes a first surface incision tangentially of a tubular element, a blade (3) for making a full cut starting from the first surface incision, means for autonomously commanding and guiding a working cycle of the scoring tool (2) and distinct means for autonomously commanding and guiding a working cycle of the blade (3); the means for autonomously commanding and guiding a working cycle of the scoring tool (2) comprising an actuator for powering a work cycle consisting in a translation in two directions, an outward run and a return run, along a predetermined first axis; the means for autonomously commanding and guiding a working cycle of the blade (3) moving the blade (3) along a second axis which is perpendicular to the predetermined first axis;
characterized by

a start position of the working run of the blade (3) being variable according to dimensions of the tubular element (6).

2. . The cutoff machine of claim 1, **characterised in that** the scoring tool (2) is symmetrical with respect to a plane which is perpendicular to the predetermined first axis, exhibiting, in a symmetrical position with regard to the predetermined first axis, two scorers (20), one of which scores in one run of the working cycle of the scoring tool (2) and another of which scores in another run of the working cycle of the scoring tool (2).
3. . The cutoff machine of claim 1, **characterized in that** the means for autonomously commanding and guiding a working cycle of the blade (3) allow for an adjustment of a start-cut position of the blade (3), which corresponds to a start position of an active run of the blade (3), in accordance with transversal dimensions of the elements (6), thus locating the blade (3) at a fixed distance from the elements (6).
4. . The cutoff machine of claim 1, **characterised in that** the actuator comprises a headstock (5) which can move along the predetermined first axis, driven by a ball-screw coupling.
5. . The cutoff machine of claim 1, **characterised in that** the actuator comprises a headstock (5) which can move along the predetermined first axis, driven by a rack-and-pinion mechanism.
6. . The cutoff machine of claim 1, **characterised in that** the actuator comprises a hydraulic cylinder equipped with a small high-pressure oil chamber able to reduce problems connected with oscillation due to oil compressibility; the cylinder being controlled by means of a closed-circuit servo-valve which can achieve controlled-force movements.

Patentansprüche

1. Schneidemaschine für rohrartige Elemente, enthaltend ein Kerbwerkzeug, welches Kerbwerkzeug (2) einen ersten Oberflächeneinschnitt tangential an einem rohrartigen Element vornimmt, ein Messer (3) zum Ausführen eines vollen Schnittes, ausgehend von dem ersten Oberflächeneinschnitt, Mittel zum autonomen Auslösen und Führen eines Arbeitszyklus des Kerbwerkzeugs (2) und getrennte Mittel zum autonomen Auslösen und Führen eines Arbeitszyklus des Messers (3); wobei die Mittel zum autonomen Auslösen und Führen des Arbeitszyklus des Kerbwerkzeugs (2) einen Stellantrieb zum Antreiben eines Arbeitszyklus enthalten, der aus einer Verschiebung in zwei Richtungen besteht, einem Aus-

föhrlauf und einem Rücklauf entlang einer vorgegebenen ersten Achse; wobei die Mittel zum autonomen Auslösen und Föhren eines Arbeitszyklus des Messers (3) das Messer (3) entlang einer zweiten Achse bewegen, welche lotrecht zu der vorgegebenen ersten Achse verläuft; **dadurch gekennzeichnet, dass** eine Ausgangsposition des Arbeitslaufes des Messers (3) je nach den Abmessungen des rohrartigen Elementes (6) veränderbar ist.

2. Schneidemaschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** das Kerbwerkzeug (2) symmetrisch im Verhältnis zu einer Ebene ist, welche lotrecht zu der vorgegebenen ersten Achse verläuft und in einer symmetrischen Position im Verhältnis zu der vorgegebenen ersten Achse zwei Kerbmesser (20) aufweist, von welchen eins in einer Richtung des Arbeitszyklus des Kerbwerkzeugs (2) arbeitet und das andere in einer anderen Richtung des Arbeitszyklus des Kerbwerkzeugs (2).
3. Schneidemaschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** die Mittel zum autonomen Auslösen und Föhren eines Arbeitszyklus des Messers (3) eine Einstellung der Schnittpfangsposition des Messers (3) erlauben, welche der Ausgangsposition des aktiven Laufs des Messers (3) entspricht, übereinstimmend mit den Querabmessungen der Elemente (6), wodurch das Messer (3) in einem festen Abstand von den Elementen (6) angeordnet wird.
4. Schneidemaschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** der Stellantrieb einen Spindelstock (5) enthält, welcher sich entlang der vorgegebenen ersten Achse bewegen kann, angetrieben durch eine Kugelumlaufspindel.
5. Schneidemaschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** der Stellantrieb einen Spindelstock (5) enthält, welcher sich entlang der vorgegebenen ersten Achse bewegen kann, angetrieben durch einen Zahnstangen-Ritzel-Mechanismus.
6. Schneidemaschine nach Patentanspruch 1, **dadurch gekennzeichnet, dass** der Stellantrieb einen Hydraulikzylinder enthält, versehen mit einer Öl enthaltenden Hochdruckkammer, die in der Lage ist, die Probleme zu reduzieren, die mit der Schwankung der Kompressibilität des Öls zusammenhängen, wobei der Zylinder mit Hilfe eines Servoventils mit geschlossenem Kreis gesteuert wird, welches Bewegungen mit gesteuerten Kräften bewirken kann.

Revendications

1. Machine de coupe d'éléments tubulaires, comprenant un outil d'incision, ledit outil d'incision (2) pratiquant une première incision de la surface tangentiellement à un élément tubulaire, une lame (3) pour pratiquer une coupe complète en partant de la première incision de surface, des moyens de commande et de guidage autonomes d'un cycle de travail de l'outil d'incision (2) et des moyens distincts de commande et de guidage d'un cycle de travail de la lame (3); les moyens de commande et de guidage autonome d'un cycle de travail de l'outil d'incision (2) comprenant un actionneur de puissance d'un cycle de travail consistant en une translation dans deux directions, une course de sortie et une course de retour, le long d'un axe fixe prédéterminé; les moyens de commande et de guidage autonomes d'un cycle de travail de la lame (3) déplaçant la lame (3) le long d'un second axe perpendiculaire au premier axe prédéterminé; **caractérisée en ce qu'**une position de départ de la course de travail de la lame (3) est variable selon les dimensions de l'élément tubulaire (6).
2. Machine de coupe selon la revendication 1, **caractérisée en ce que** l'outil de coupe (2) est symétrique par rapport à un plan perpendiculaire au premier axe prédéterminé, présentant, dans une position symétrique par rapport au premier axe prédéterminé, deux inciseurs (20), l'un desquels incise dans une course du cycle de travail de l'outil d'incision (2) et un autre incisant dans une autre course du cycle de travail de l'outil d'incision (2).
3. Machine de coupe selon la revendication 1, **caractérisée en ce que** les moyens de commande et de guidage autonomes d'un cycle de travail de la lame (3) permettent un réglage d'une position de début de coupe de la lame (3), qui correspond à une position de départ d'une course active de la lame (3), selon les dimensions transversales des éléments (6), en disposant ainsi la lame (3) à une distance fixe par rapport à l'élément (6).
4. Machine de coupe selon la revendication 1, **caractérisée en ce que** l'actionneur comprend un porte-outil (5) pouvant se déplacer le long du premier axe prédéterminé, actionné par un accouplement de vis à billes.
5. Machine de coupe selon la revendication 1, **caractérisée en ce que** l'actionneur comprend un porte-outil (5) pouvant se déplacer le long du premier axe prédéterminé, actionné par un mécanisme pignon-crémaillère.
6. Machine de coupe selon la revendication 1, **carac-**

térisée en ce que l'actionneur comprend un vérin hydraulique équipé d'une petite chambre d'huile à haute pression pouvant réduire les problèmes liés aux oscillations dues à la compressibilité de l'huile; le vérin étant contrôlé au moyen d'une servo-valve en circuit fermé pouvant effectuer des mouvements avec force contrôlée.

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